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ABSTRACT

Defining and developing a quality control technician curriculum for an associate degree program is a difficult and puzzling job. There are as many definitions of quality control and curriculum ideas as there are educators asked. However, one could start by dividing the field into its major areas--heavy manufacturing, maintenance, research, and service industries. Further division of these areas results in certain common subject areas. Data manipulation is common to all areas; on the technician level, it involves generation of data, manipulation of data, and corrective action. A technician curriculum must address all three areas or the graduate will not be prepared for employment. Spartan Campus of the National Education Corporation originally developed a quality control technical curriculum focused on defect detection from welding and fatigue, but as technology became more sophisticated, it added other areas of quality control. The technician was trained to be a bridge between assembly workers and quality management personnel. As the curriculum produced graduates, it became well known. In-plant programs were started, and certification became extremely important. If the needs of the customer are targeted, a quality control technician curriculum can be dynamic and successful. (KC)

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QUALITY CONTROL TECHNICIAN CURRICULUM
AN ELUSIVE BUTTERFLY

A paper presented to the education community
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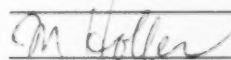
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QUALITY CONTROL TECHNICIAN CURRICULUM

An Elusive Butterfly

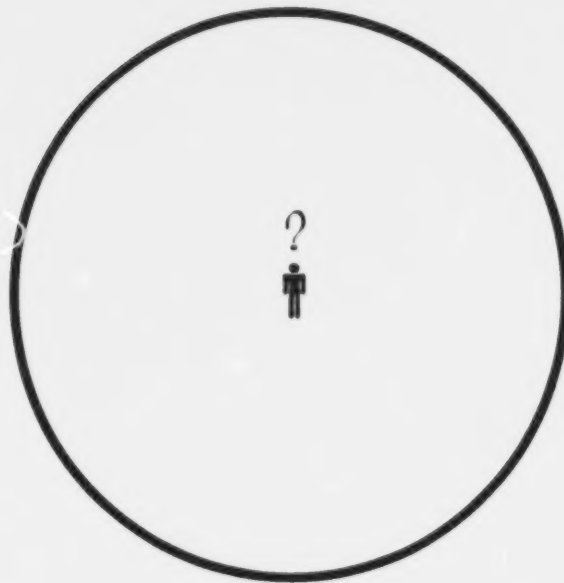
There is one truth that permeates quality control education: "Quality Control curriculum design is as elusive as the discipline it attempts to convey." If you ask five people to define what quality means to them, chances are, you will get five different answers. This same principle holds true in Quality Control Technician curriculum design. Ask five different educators what a Quality Control Technician curriculum should consist of and you will more than likely get five different answers. Likewise, if you ask five different Quality Engineers what a Quality Control Technician curriculum should consist of, you will most definitely receive five different answers.

Quality, by nature, is an ideology that requires much contemplative thought. There are problems to solve, processes to correct and people to motivate. As an engineering discipline, quality control has many fine curricula available; however, on the technician level there are very few programs that are of real value. I do not wish to offend anyone, but that truth remains. The objective of a technical course is to prepare a person to enter the work force. That person expects to have the basic skills needed to survive in his or her new career. Because of the global concept of quality, and the requirements of a technical curriculum, many educators are at a loss when it comes

to a Quality Control Technician curriculum.

When I was given the job of developing a Quality Control Technician curriculum, I found myself in this situation.

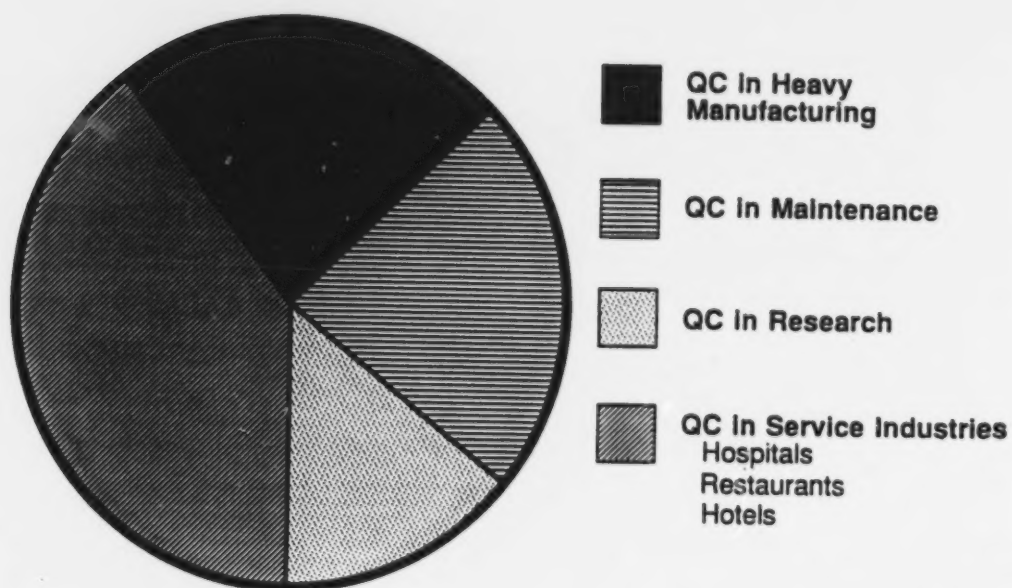
Quality Control Industry



I found my self in the middle of a subject area so vast that it was impossible to imagine a school on the holistic level. It might be approached in an engineering program of from four to six years. But I did not have that kind of time. Mine was to be an associate degree program.

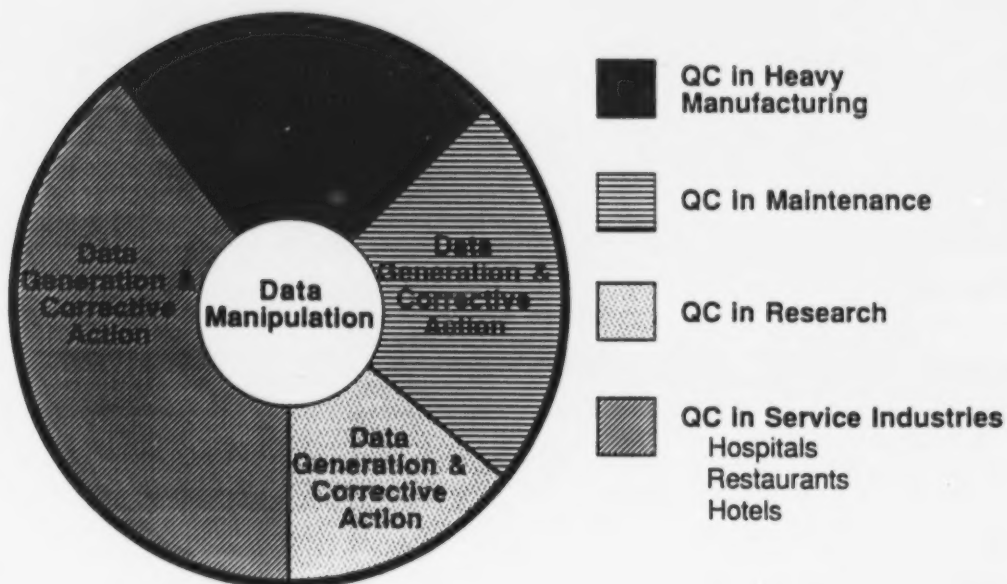
I began to break quality control into its major areas. When I did, it began to look something like this.

Quality Control Industry



As I divided these areas further, certain subject areas began to show themselves in common.

Quality Control Industry



In almost every area of quality control, the manipulation of data was very similar. It is for that reason, that most quality technician curricula are made up almost entirely of statistics. On a technician level, it is doing an injustice to the student to have a curriculum so lopsided in favor of statistics. There are three main areas to deal with on a technician level. They are (1) generation of data, (2) manipulation of data, and (3) corrective action. A technician curricula must address all three or the graduate will not be prepared for employment.

As an example let us compare quality in an assembly line environment and in a service organization such as a hotel. Please keep in mind that this is on a very simplistic level.

In the area of assembly, data is gathered by departmental audits, but mainly through sample inspection, destructive testing and other data gathered from the product as it progresses through the line. The key here is that the data is obtained from the product or part being made. Hotel data is gathered by departmental audits and customer surveys. The techniques used to gather the data are quite different. However, the manipulation of the data will be quite similar. Statistical processes using charts and graphs to show trends will be used in both cases. The corrective action of the assembly line will be directed toward the refinement of the process that creates the part. It may be aimed at either the hardware or personnel or both. Corrective action in the hotel will be quite different.

I realized that a technician must be able to perform in all three areas. The program would not be readily accepted if the students could operate in only one area, namely data manipulation.

In this position, I found myself considering many different options. For many of you, this may be your biggest problem in curriculum development for Quality Control Technicians. I urge you to sit down and list the factors that influence your school.

Look at the areas that you now teach. In my deliberations, I reviewed the needs of quality control in different types of industry. As I did, it became apparent to me that I would not be able to meet all the needs of the quality control industry with one curriculum. I was forced to look at specialized areas of quality and use as much of my existing curriculum as possible to meet the needs of a well defined group. In looking at what industry needed and what Spartan had in place, I determined that our curriculum would initially move into the area of heavy manufacturing.

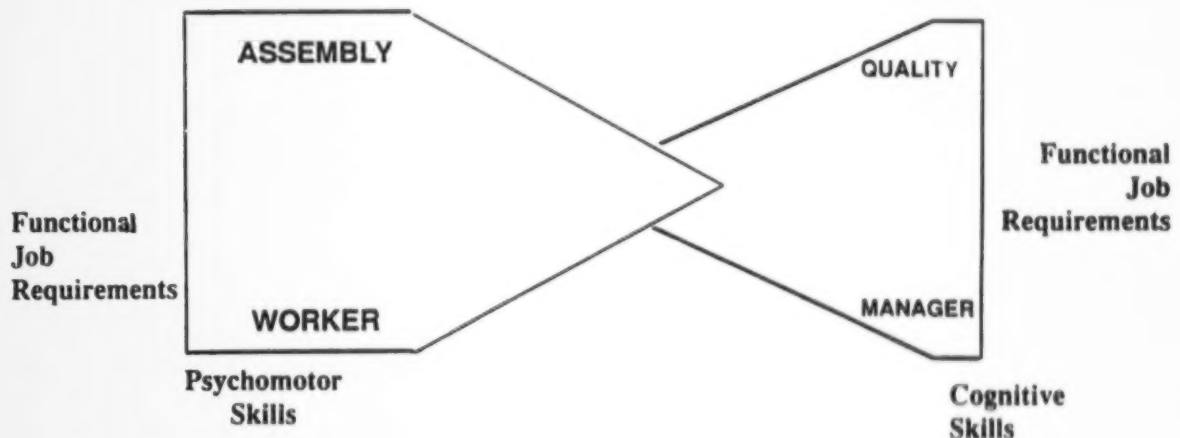
This may seem to be a very narrow perspective to you; however, to meet the needs of an industry you must begin by meeting the needs of a small part of that industry. If your quality control education curriculum is to succeed, you must define which part of the quality industry you are serving. This can be a very difficult job. It is more difficult than the actual development of the curriculum. Most Quality Control Technician programs fail to succeed because of a failure to give their graduates marketable skills from a well defined curriculum.

Spartan's Nondestructive Testing curriculum, as it was originally developed and expanded, focused on defect detection from welding and fatigue. As NDT technology became more sophisticated, it found its way into the manufacturing industry. It has been used to quickly find defective products during assembly. Due to the

pressure applied by international competition, the manufacturing industry can no longer survive if it focuses on defect detection. You can not inspect quality into a part. NDT is of most value to a manufacturer as a method used to gather data. Thus the objective of preparing a quality control technician with emphasis in the area of special inspection was born.

This gave me a well defined group to target the curriculum toward. In heavy manufacturing, there is a great difference in the training required for the assembly worker and the Quality Engineer. This illustration shows the skills required in a manufacturing process.

MANUFACTURING OVERVIEW



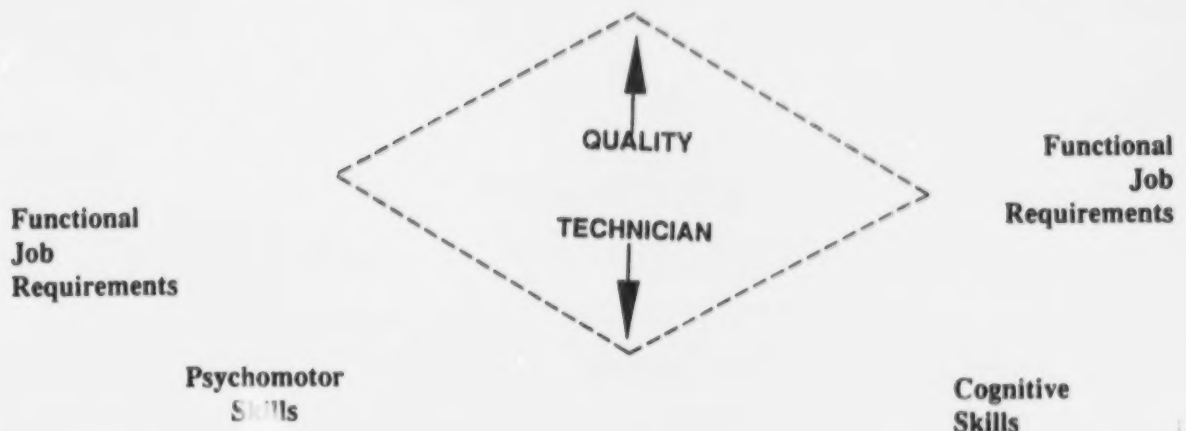
SKILLS NEEDED TO PERFORM JOB REQUIREMENTS

People must function in the full range of skill if a manufacturing process is to work. Those skills are listed horizontally across the bottom of the chart. The length of the vertical lines or the thickness of the figure indicates the extent of those skills. If the line is very long, there is a large dependency on those type of skills. As an example, let us look at the skills required to perform the job requirements of an assembly worker. The average assembly worker will operate within the parameters shown on the left. That person will rely heavily on manipulative skills to perform his job. There will be very little cognitive skill required to do the job. The training that person receives should be commensurate with the requirements of his job. Training should be focused to develop the psychomotor skills. On the other end of the spectrum, is the Quality Control Engineer or Quality Control Manager. This individual's job function parameters would look something like those on the right. A large amount of cognitive skill is required to meet the demands of this position. Very little psychomotor skills are needed. Again, as before, training for this person should be focused on the cognitive requirements of the job. The training as pictured here is idealistic. It presumes that the training of the QC manager is on the level of a four year baccalaureate degree. As we look at the job requirements of each, we can see very little "common ground" between the assembly worker and the QC Engineer. Their job requirements are different, their training has been different, their whole focus on manufacturing may be very

different. The question here is not one of status or worth, but rather one of role and function. Historically these two groups have had a hard time relating to each other.

As I looked at the disparity between the two job requirements, the solution became clear. To be of use to the manufacturing industry, a Quality Control Technician must "bridge the gap" between the assembly personnel and the quality management personnel. The job requirement parameters for a Quality Control Technician would look something like this.

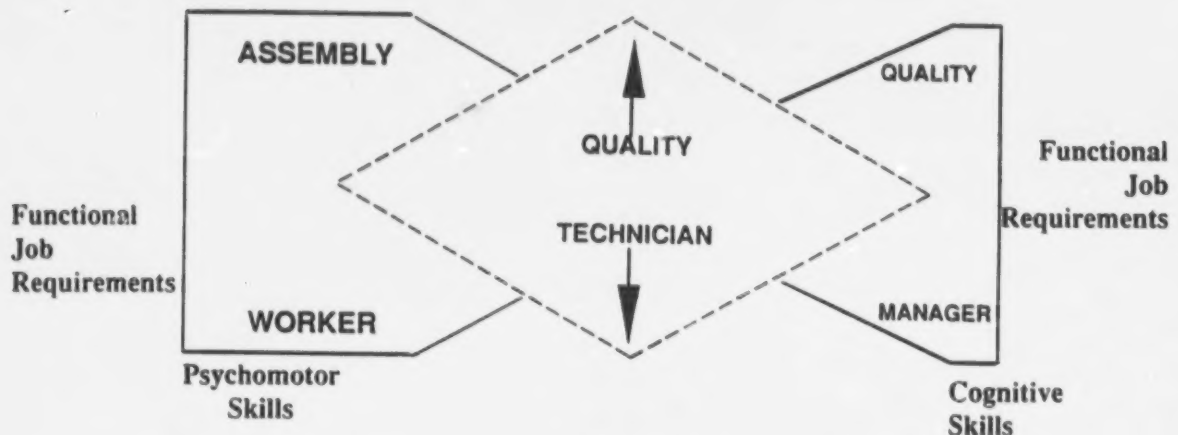
MANUFACTURING OVERVIEW



SKILLS NEEDED TO PERFORM JOB REQUIREMENTS

The amount of manipulative required skill will be greater than the QC manager's but less than the assembly worker's. Conversely, the amount of cognitive skill will be less than the QC manager but greater than the assembly worker. As the training of both the assembly worker and the QC manager required developing skills used for their jobs, so also must the training for the QC Technician develop skills needed for his job.

MANUFACTURING OVERVIEW



SKILLS NEEDED TO PERFORM JOB REQUIREMENTS

When this is done properly, there is a new bonding between production and quality. This gives the ability for increased communication and understanding between the two departments.

When the training of the QC technician is commensurate with the job requirements, as I have outlined, management has the latitude to utilize the individual wherever needed: as an inspector utilizing more psychomotor skills than cognitive, or as auditor/analyst using more cognitive skills than psychomotor. Let me show you how the classes would break down. Insert your own areas of expertise in the area labeled Psychomotor/Cognitive.

PSYCHOMOTOR/COGNITIVE	COGNITIVE/PSYCHOMOTOR
* Magnetic Particle Inspection	* Concepts of Quality
* Dye Penetrant Inspection	* Job Requirements in QC
* Industrial Radiography	* Basic Statistics
* Ultrasonics Inspection	* Statistical Applications
* Eddy Current Inspection	* Quality Management

This is by no means the entire curriculum as it is now set up, but it serves to show how the classes are divided.

When developing the curriculum material, keep in mind that professional certification may be very important to your graduates. You should always use those certification standards when determining the extent and depth of your curriculum. There may also be military standards that will aid you in your curriculum development.

In my particular area, the material presented needs to meet the educational requirements of the American Society of

Nondestructive Testing (SNT-TC-1A), The American Welding Society (Certified Welding Inspector), Nuclear Regulatory Commission (Radiation Safety Course), American Society for Quality Control (Certified Quality Technician), Texas State Board of Health, Mil-Std 410D (Certification Of NDT Personnel). With out training to these requirements, the people in industry are not certain what type of training the graduates have. Seek out what certification requirements will enhance the placement of your graduates. Then begin to meet those requirements through curriculum development.

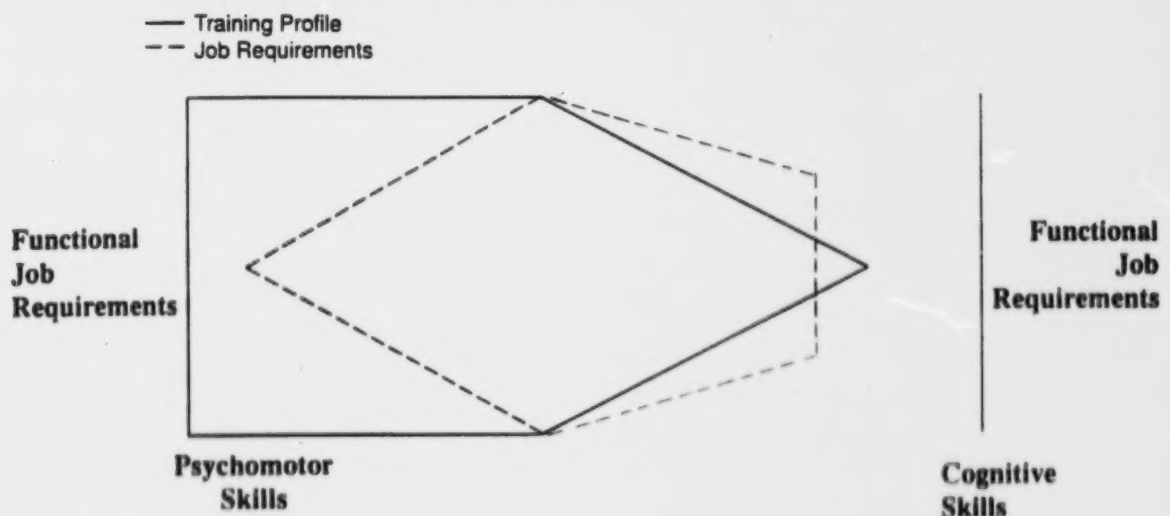
This approach has worked extremely well for full-time students trained on campus. Placement into the work force is very high and feedback from employers is positive. It should be kept in mind that the placement effort must be as well defined as the curriculum development. To try to place my graduates into a hotel environment would not work well at all. Our placement effort has been very carefully targeted toward companies that would need the services of people with our training.

As I surveyed what I had done, I was feeling very smug about the success of the curriculum. As the program continued, and the reputation of our graduates grew, I began to get requests from industry to train their people in-plant. I realized that my model was serving only a small part of the small group that I labeled "manufacturing".

As I reviewed my chart, I realized that I took a very important aspect for granted. I presumed that the QC manager was trained in a four year institution, heavy in cognitive training. This is hardly the case. I began to glean information from those calling and realized that although the program was working well I could now meet the needs of industry by training the people already holding QC positions.

I realized that most quality managers have very little formal training in quality control. They tend to be promoted from within the company and, as such, their training is dependent on the company. Until recently, the options open to companies concerning QC training have been very few. So we began to have training profiles that look like this.

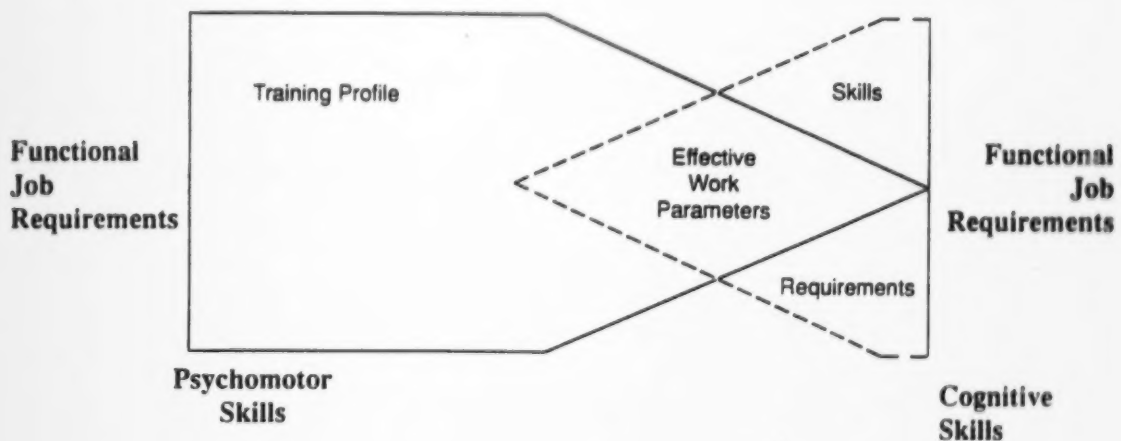
MANUFACTURING OVERVIEW



SKILLS NEEDED TO PERFORM JOB REQUIREMENTS

The training tends to follow solid line pattern, while the skills requirement tends to follow dashed line pattern. If the person continues to earn promotions, it is possible and even probable that we will have this configuration.

MANUFACTURING OVERVIEW



TRAINING NEEDED TO PERFORM JOB REQUIREMENTS

Notice, the overlapping area is the only effective work parameter for that person. After a person has progressed through the company to this position, will he be receptive to the

idea of night school? I think not. The frustration that this kind of skill requirement versus training needs spawn, is a very ineffective, apathetic QC department. As one of my instructors put it, "effective early retirement". This has caused a tremendous demand for quality training in industry itself.

This model gives us something new to think about in regards to curriculum design. Our approach must be the same however. We must target our curriculum into the area that needs the most help. If the need is for technical skills in the area of Nondestructive Testing, the curriculum might look something like this:

INDUSTRIAL RADIOGRAPHY

Level I (40 hours)

Level II(40 hours)

MAGNETIC PARTICLE / DYE PENETRANT

Level I (25 hours)

Level II(15 hours)

ULTRASONIC INSPECTION

Level I (40 hours)

Level II (40 hours)

It is extremely important that these courses conform to the certification requirements and that you document them as needed by the customer. It depends a great deal upon the type of contracts the customer is working to, as to what kind of certification will be required. If the majority of the contracts are government, certified training to Mil-Std 410D will be required. If the customer is working under contracts requiring ASNT certification, your course must conform to SNT-TC-1A. You

will find that these people are quite insistent on certifiable, documented training. If you can not provide the documentation of the type of training, do not bother bidding on their contract.

In the area of quality technology, courses may be directed to different levels of industry. This must be done because quality responsibilities are different for different jobs through the company. For example, the assembly line worker might benefit from courses like these:

BLUEPRINT READING
DIMENSIONAL METROLOGY
MANUFACTURING PROCESSES
DEFECTS CAUSED BY MACHINING
BASIC STATISTICS
EMPLOYEE INVOLVEMENT GROUPS TRAINING.

These classes should be targeted to assembly personnel to give information on a level needed by them to function in their jobs and as a motivator to encourage quality awareness.

For upper level quality managers your curriculum must address cognitive concepts. Research the cognitive concepts in the area of quality you are addressing and then build your curriculum to meet the need. You might keep in mind that these people are aware of the need for quality. They want to know how to bring it about. Courses offered to these people would look like this:

BASIC STATISTICS
FUNDAMENTAL USES AND APPLICATIONS OF STATISTICS
STATISTICAL PROCESS CONTROL
STATISTICAL PROBLEM SOLVING
DESIGN OF EXPERIMENT
DETERMINING THE COST OF QUALITY.

These courses would be intense, short duration classes aimed at meeting specific needs of the quality team.

Finally, there is one more group of people who must be educated about quality. That group is top level management. Without the support of top level management, the quality effort will surely fail. These courses must be short, concise, and exciting. They are as much a sales tool for quality as a "how to" course. These courses might look something like this:

QUALITY CONCEPTS
EMPLOYEE INVOLVEMENT
HOW TO READ QUALITY CHARTS
VENDOR QUALITY
NDT AND METROLOGY IN MANUFACTURING

I urge you to be wise in the area of industry training. Use the information you already have wherever possible. There is no need to reinvent the wheel every time you teach a class. Where feasible, divide the curriculum into modules that can stand alone in a seminar or mini course. The course material for each of the industry classes shown above can be obtained from the course material offered to the on campus full-time students.

Time as well as certification is important in industry training. You must give out the required information, but you must now do it in a short time period. You will not be able to train top level managers for more than one day. You will not be able to train quality control technicians for more than a week. You

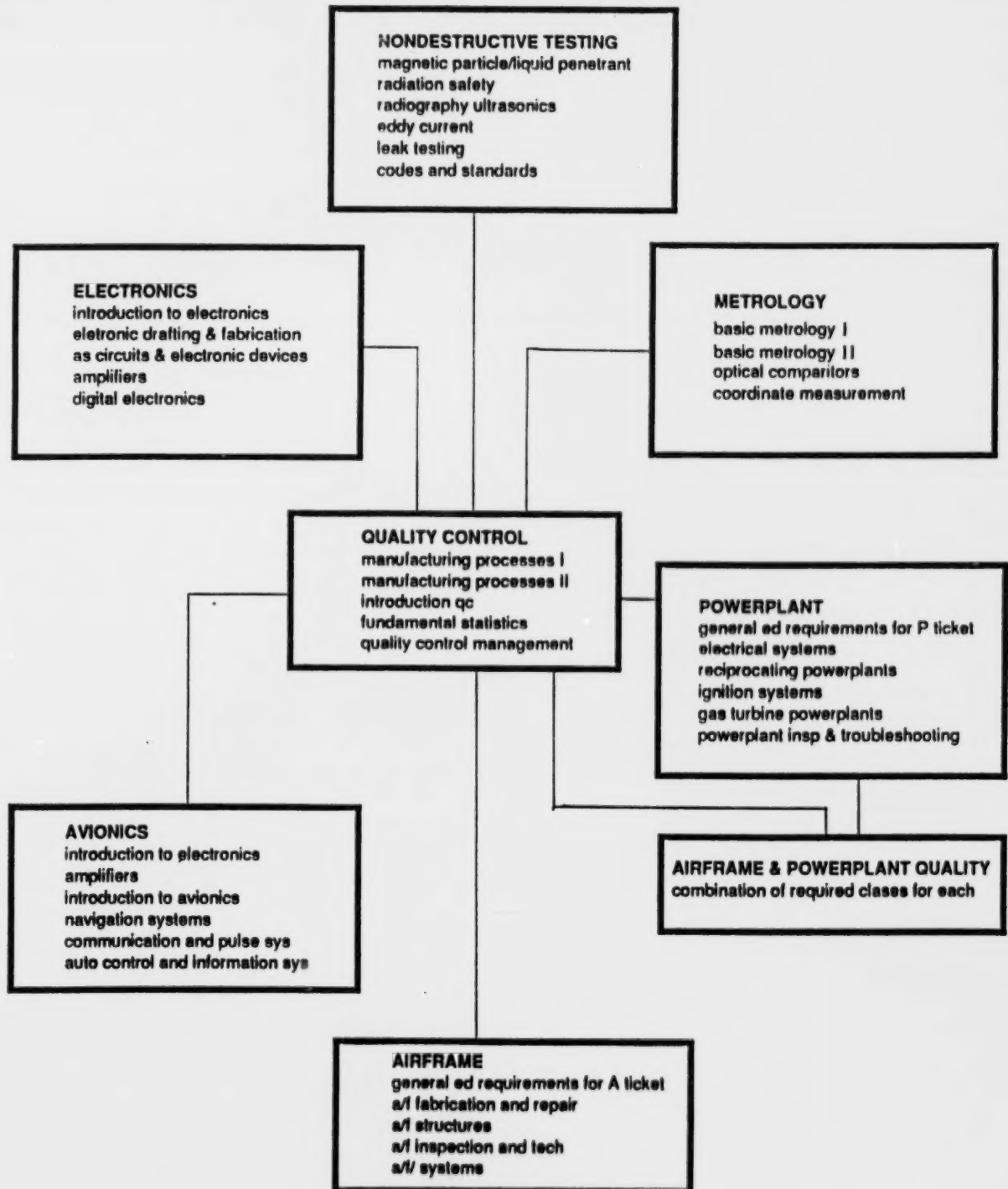
will not be able to train assembly workers for more than a couple of days.

If we are wise and target well the need of our customer, a Quality Control Technician curriculum can be more than acceptable; it can be dynamic! It is time for educators to get away from the concept that quality control education is some kind of mystic theology. Some times I think we teach our students to pray to the great god "QUAL" and then tell them to instruct their bosses to "have faith". We must approach quality curriculum as any other technical discipline, one step at a time.

You have already accomplished the first step! I am speaking to a group of educators very accomplished in their respective fields. You are here today because you are involved in "TECHNICAL" education. You represent communications, electronics, computer hardware & software, medical profession, business management, and service industries of all kinds. Begin where you are when developing your quality control technician curriculum. Use the talent and material you have to develop A Quality Technician curriculum.

We must use what we have to our advantage. I would caution you not to create a stepchild by merely adding a couple of QC classes. Create a curriculum including much of your existing curriculum. You must research quality control in your field and integrate those concepts into your existing classes. Use the advisors you have in your field to give you the names of experts in your quality area. Talk with as many people as possible to target your curriculum. Become involved in your local organizations that promote quality. And find certification requirements for people with your training and meet those requirements to the best of your ability. Then build on those concepts that you have gathered, classes of quality. As an example of what I mean, let us look at the possibilities for Spartan School (see next page). There are several opportunities for our school to grow into additional areas of quality. Refer to the illustration on the next page. Each of these fields could be developed into a dynamic QC program, much like the existing one. Each of your fields could likewise be developed into such a program.

OPPORTUNITIES FOR GROWTH IN QUALITY CONTROL



We in the technical education field have the potential to make a significant difference in the U.S. economy by impacting its industries. I urge each of you to explore the opportunities in your field and become involved in quality technology. You may very well become a fanatic as I have. Quality, or the lack of it, has Affected every area of our lives and our economy. Our country has grown from a culture in search of excellence to one abhorrently content with mediocrity. It is so true that in every victory are the seeds of defeat. This truth has become very evident in our fattened economy. But as I see our country struggle to regain its position in the world economy, I am becoming more aware of the truth that in every defeat lie the seeds of victory.

Not since the development of the microchip have educators had the opportunity to have such an impact on our economy. Let us not let the opportunity slip through our fingers. Become quality experts in your area of interest.